

Iceland
Liechtenstein
Norway grants



Ministerstvo financí
České republiky

TOPIC: Wind power plant

NAME: Adam Smejkal

PROJECT: Comparison of energy potencial of Iceland and the
Czech Republic

DATE: 1/ 8/2021 – 31/ 8/ 2022



Wind power plant

Smejkal Adam

Kinetic energy

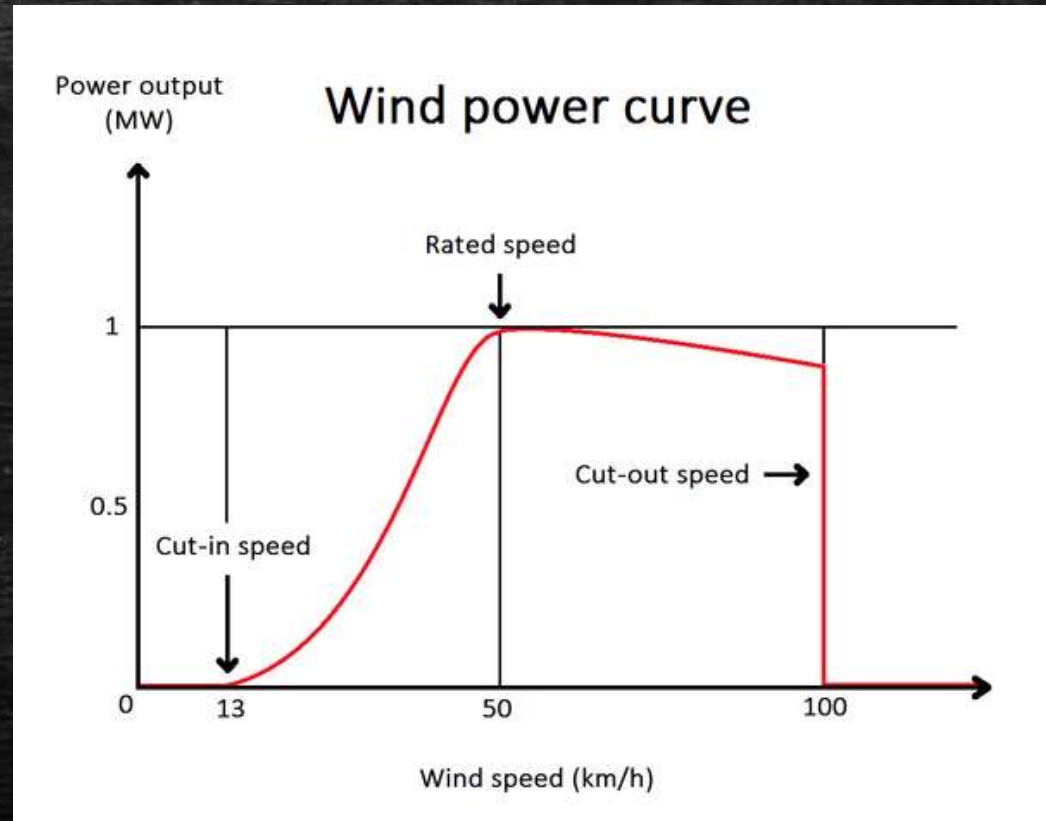
$$E_k = \frac{1}{2} m \cdot v^2$$

Where:

E_k = Kinetic energy [J]

v = velocity [m/s]

m = mass [kg]



na rychlosti vzduchu The curve of the dependence of the produced electrical energy

Efficiency

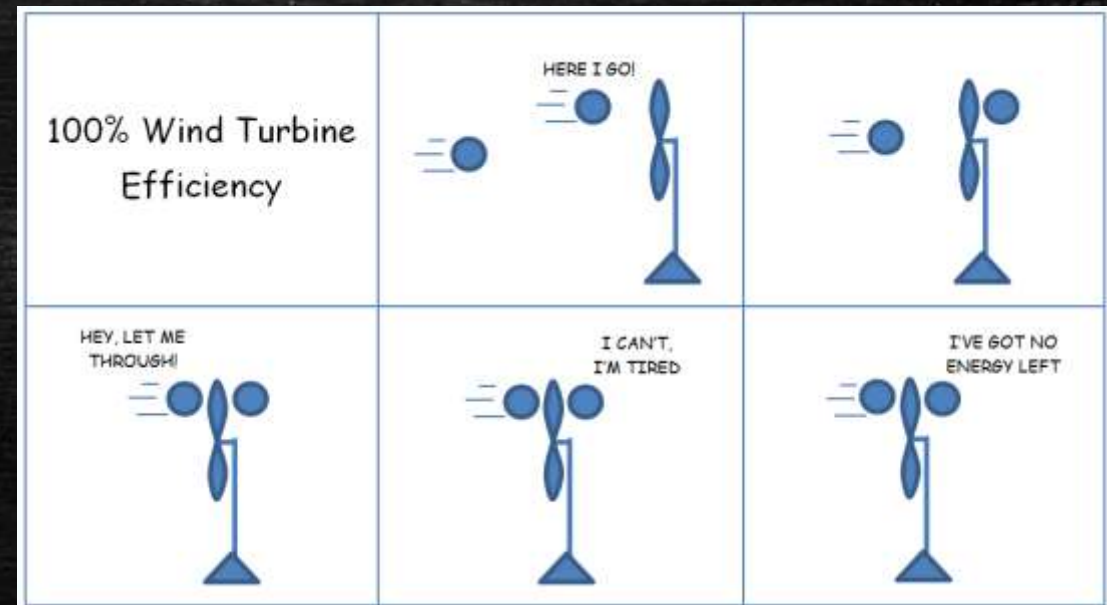
Betz's law :

According to Betz's law, no turbine can capture more than 16/27 (59.3%) of the kinetic energy in wind.

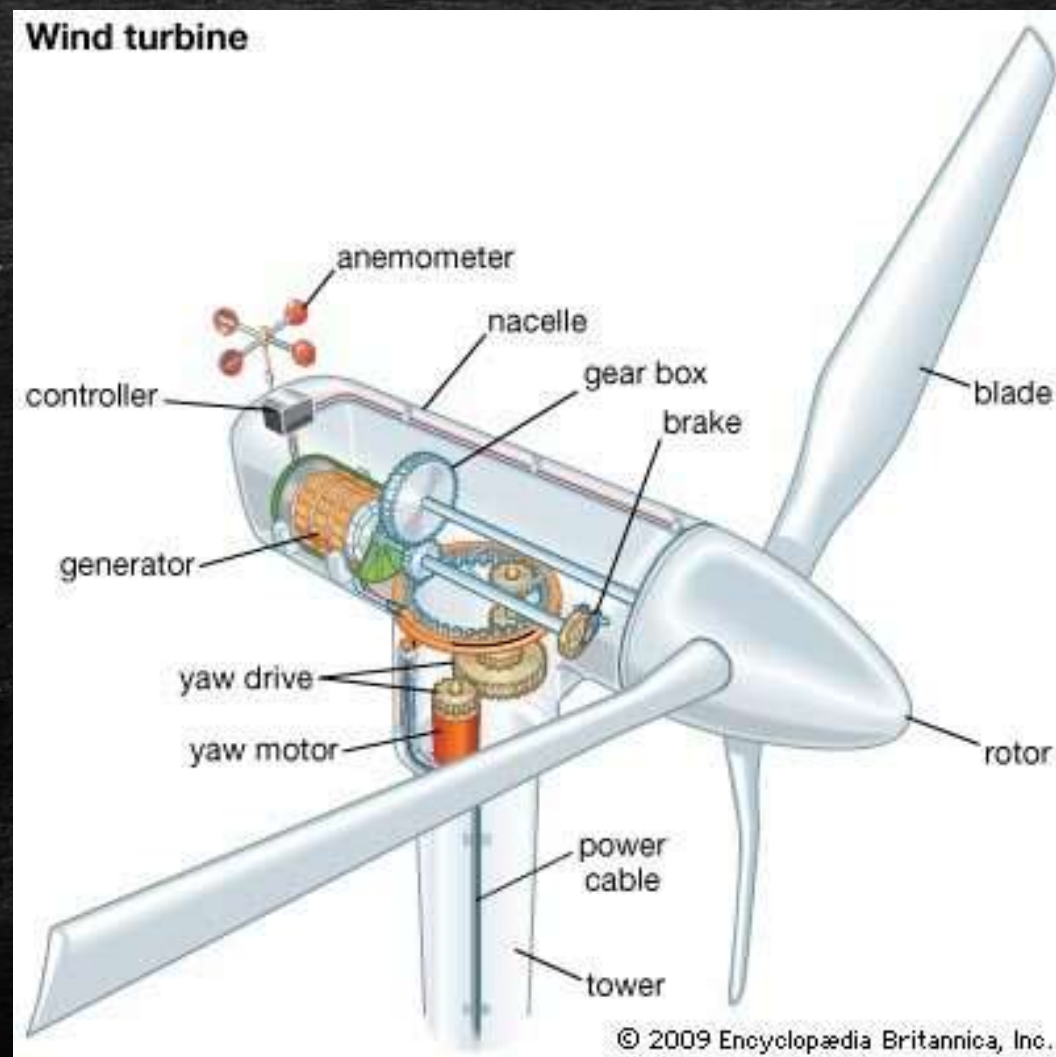
$$\eta_{max} = \frac{16}{27} = 0.593$$

In fact:

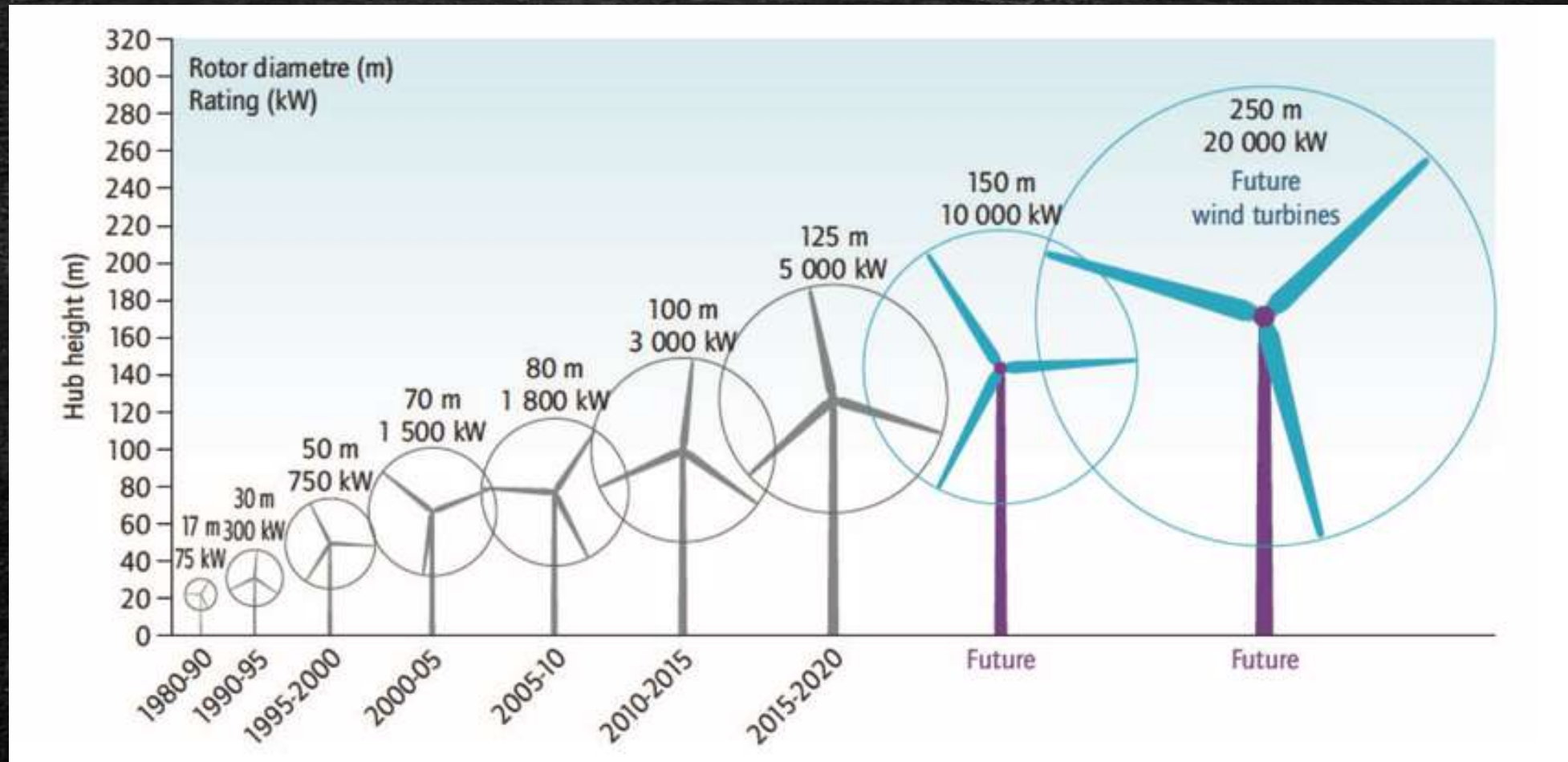
Under ideal conditions, the efficiency is around 40%



Structure



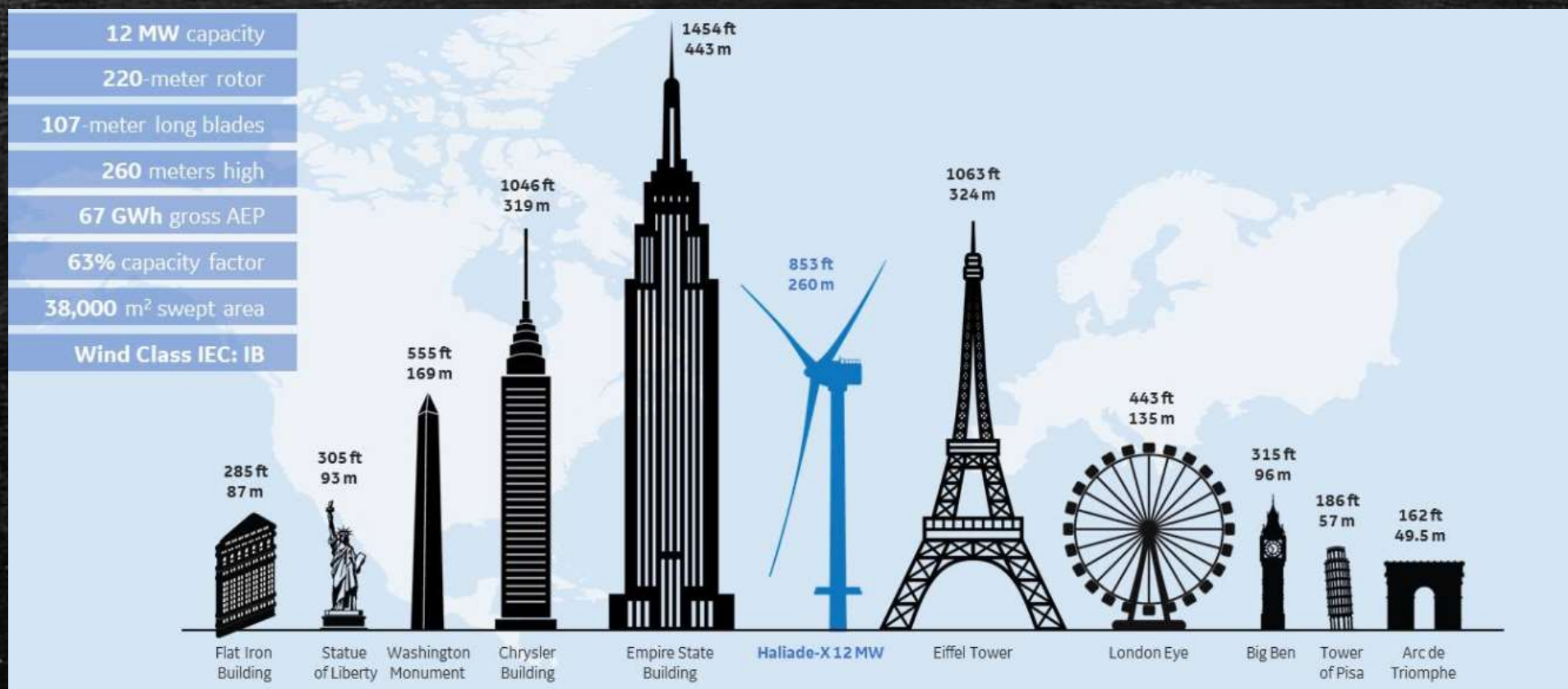
How to get more energy?



Bigger = better

The most powerful wind turbine in the world

Haliade-X 12 MW



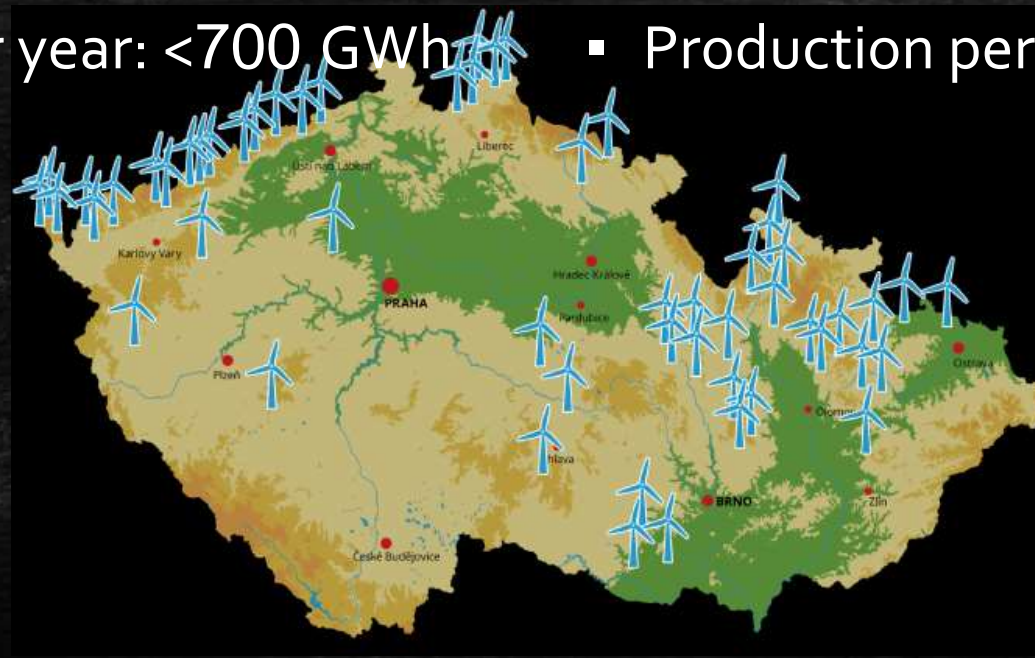
Comparison of the Czech Republic and Iceland



- Total amount: 202
- Overall performance : 339 MW
- Production per year: <700 GWh



- Total amount: 4
- Overall performance : 3MW
- Production per year : 6,6 GWh



Advantages and disadvantages

➤ Advantages

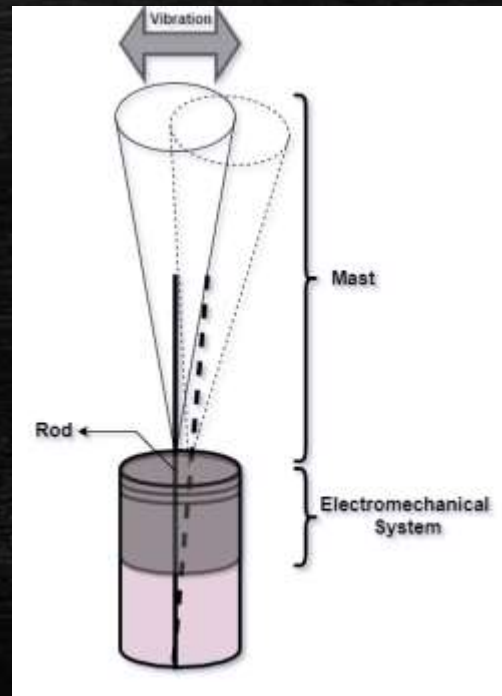
- **No emissions** are produced during operation
- **Renewable source** of electricity
- They can be **built locally** on the territory of states
- Low failure rate
- **Recyclability** of individual parts

➤ Disadvantages

- Performance depends on wind strength and direction
- **Disruption** of the natural character of the **landscape**
- High acquisition **costs**
- Low **lifespan** (cca 25 years)
- **Noise**

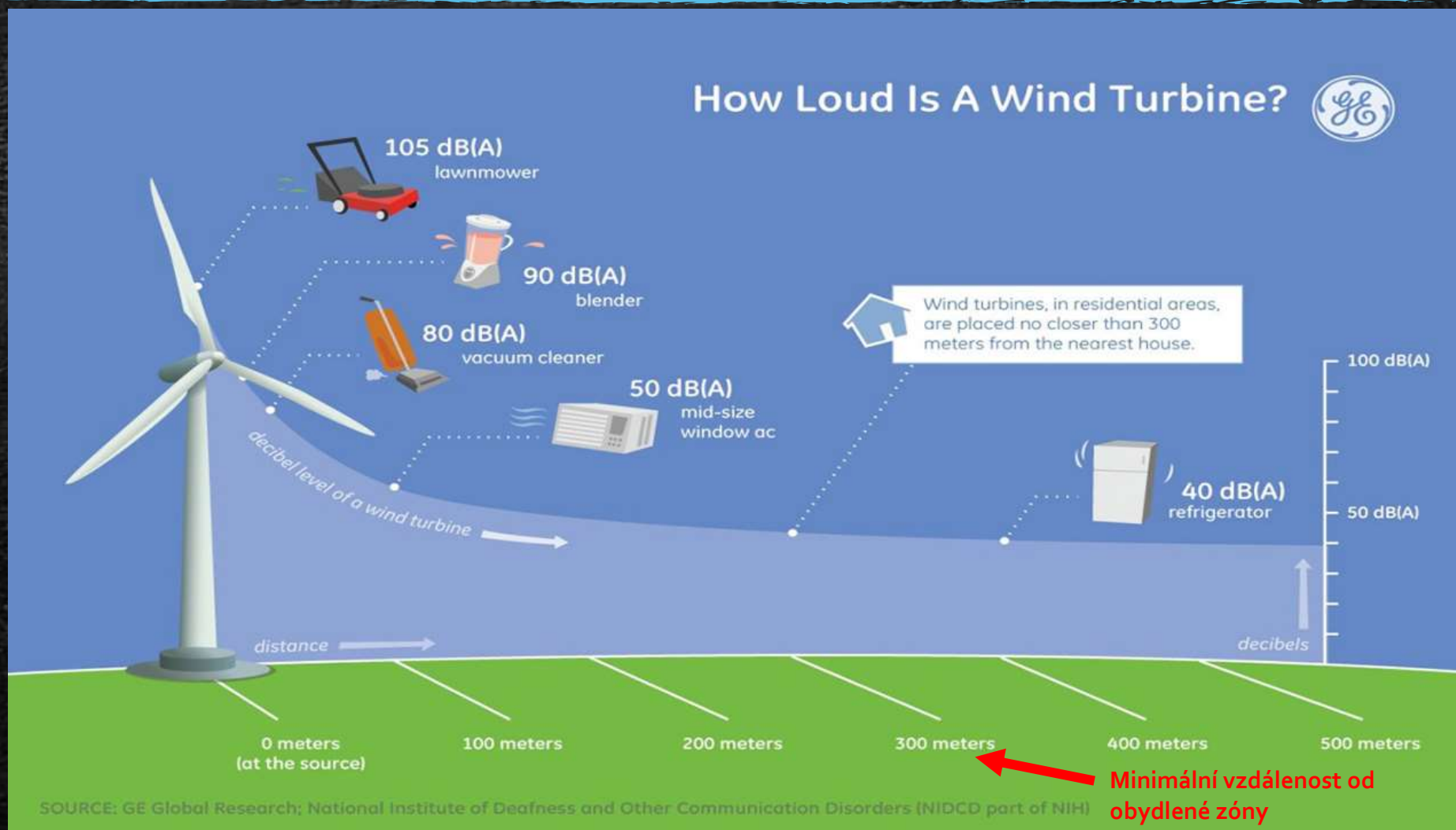
The future of wind farms

- No blades
- Lower noise
- Electricity produced using air vibrations
- Longer service life and less demanding maintenance
- Harmless to wildlife



Vortex Bladeless wind turbine

Noise from wind farms



Impact on the landscape

A 10-year study from Ontario, USA shows that: Each wind turbine kills around 5 birds and 12 bats per year, which is a relatively small amount compared to other non-natural pests

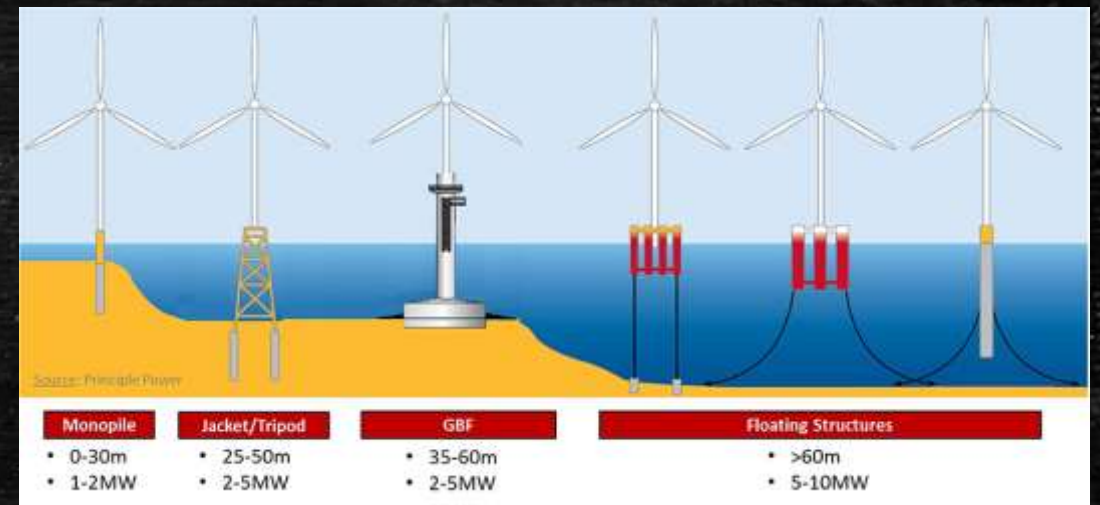


Offshore wind farms

- HORNSEA 2** - The largest wind farm at sea
- 165 turbines
 - 90 kms off the coast of England
 - Capacity 1,3 GWs
 - It supplies up to 1.4 million households



Wind farm in the North Sea



Method of anchoring wind turbines to the seabed

Thanks for your attention

Links:

<https://www.cnbc.com/2022/09/01/huge-offshore-wind-farm-hornsea-2-is-fully-operational-orsted-says.html>

<https://www.elektrina.cz/jak-funguji-vetrne-elektrarny>

https://www.researchgate.net/figure/Evolution-of-wind-turbine-size-and-future-prospects-Picture-from-IEA-2013_fig3_332180389

https://energyeducation.ca/encyclopedia/Wind_power

[Frontiers | Wind Energy in the Mediterranean Spanish ARC: The Application of Gravity Based Solutions \(frontiersin.org\)](#)
[Betz's law – Wikipedia](#)

https://en.wikipedia.org/wiki/Kinetic_energy

[Wind energy: turbines are getting taller, bigger, and more powerful – Vox](#)

[Bladeless Wind Turbines | Vortex Bladeless | Earth and Human](#)

[Bladeless Wind Turbines May Offer More Form Than Function | MIT Technology Review](#)

[Are wind farms a threat to wildlife? | Let's Talk Science \(letstalkscience.ca\)](#)

<https://www.energie.cz/vetrne-elektrarny-aneb-kouzelne-vetrniky/>

<https://www.epet.cz/vetrna-energie-vyhody-nevyhody-a-princip-fungovani/>

<https://abcbirds.org/blog21/wind-turbine-mortality/>

https://www.researchgate.net/figure/Bladeless-wind-turbine_fig1_355835466

<https://vortexbladeless.com/technology-design>